

point, others run on, five miles and more, straddling valleys and escarpments in their unswerving course. These surface drawings make little sense on the ground, and no aerial photographs do them justice. But from a light aircraft you can only gasp with amazement at their scale and the imagination of their makers.

As you bounce about the sky in the thermals that rise off the plain, you soon distinguish other figures. Apart from the geometric forms there is a zoo of animals and birds, looking rather like Steinberg drawings on an enormous scale. There is a whale. There are a guano-bird, a pelican, a humming bird, other unrecognisable birds and a frigate bird, with a distended sac under its bill. There is a dog. There is an Amazonian spider-monkey with a prehensile tail curving upwards in a spiral. There is a copy of a spider (of a species called *Ricinulei* that copulates with its hind leg). There is a tom-toddy figure with head and no body; a flower; a strange kind of seaweed; and a beast, half-bird and half-snake. There is also a lizard with its body shorn in two by the highway.

The lines on the Pampa de Ingenio were spotted in the late Twenties by the Aerial Survey of Peru. But for more than ten years the archaeologists were either ignorant of their existence or chose to ignore them. In 1939 Dr Paul Kosok of Long Island University was surveying Ancient Peru and followed up a rumour of ancient irrigation channels on the Pampa. He found the mysterious lines and was doubly astonished when the figures of birds and animals emerged from under his footprints. Kosok was not perplexed by the origin of the figures. Their style roughly coincided with those that decorated the pots of the local Nazca culture (even if the figures on the desert were finer and less folkish than the figures on the pots). But other questions troubled him. What was the point of this colossal creation when its makers, who did not have the aeroplane, could never have seen them properly? How could a people of simple peasants and warriors have mastered their superlative surveying technique without a knowledge of

## MARIA REICHE: THE RIDDLE OF THE PAMPA

Maria Reiche is a tall, almost skeletal, German mathematician and geographer who has spent about half her seventy-two years in the Peruvian desert surveying the archaeological monument known as the 'Nazca lines'. This astonishing curiosity lies on the Pan-American Highway some three hundred miles south-east of Lima and fifty miles inland from the coast, a flat waterless plain, lying high above two irrigated valleys, with the foothills of the Andean Cordillera backing up behind. This plain, the Pampa de Ingenio, is covered with a thin layer of sand and pebbles which has oxidised a warm brown colour on the surface. It has a texture rather like a meringue and overlies a bed of whitish alluvium. If you so much as tread on the Pampa you leave a white footprint that will last for centuries.

Nearly 2,000 years ago the local inhabitants realised they could use their pampa as a gigantic etching plate. And over the generations, they made what is surely the largest, and certainly one of the most beautiful, works of art in the world. The surface of the desert is furrowed with a web of straight lines, linking huge geometric forms — triangles, rectangles, spirals, meanders, whip-like zig-zags and superimposed trapezes — that look like the work of a very sensitive and very expensive abstract artist. There are lines as thin as a goat path, and as wide as airport runways. Some converge at a single

higher mathematics?

By chance Kosok timed his visit to coincide with the Winter Solstice, 21 June, the shortest day in the Southern Hemisphere. That evening at sunset he was crossing the Pampa where several lines ran in an east-west direction. He was delighted to find that the lower rim of the sun touched down at a point where one of the lines met the horizon. He decided that the line had been made for determining the date of the Winter Solstice. And he went on to speculate that all the lines and geometric forms were used as sightings to predict the risings and settings of the sun, moon and stars. The Nazca people, he said, had imprinted on the desert 'the largest astronomy book in the world'.

The Nazca Culture had been discovered in 1905 by the German Peruvianist Max Uhle. It was a smallish empire of warriors and peasant cultivators that flourished and declined between the second and eighth centuries of our era. The empire looked in two directions – across the Cordillera to the jungle, with its humming birds, its spider-monkeys and spiders; and to the sea coast, where white guano islands float on a heaving silvery sea. Nobody knows the real name of the Nazca people. First they were absorbed into the Inca and even earlier empires; then the Spaniards killed off the Indian population of these valleys and assured for them the anonymity of oblivion. One can but reconstruct their lives from the things they buried with their dead. And this is a rather hazardous business, since tomb-robbing is almost a national pastime and the robbers (the *huaceros*) have ransacked all but a few cemeteries. Seen from the air, the sides of the valleys are pockmarked with their holes.

On their patchwork of fields, irrigated by the annual run-off from the Andes, the people of Nazca grew the potato, the sweet potato, the avocado, the chile pepper, the lima bean, maize, manioc, pineapples, guavas and a multitude of little-known grains and fruit and vegetables. They had fishing boats and rafts which could only skim one of the world's best

fishing grounds. For meat they ate llama and large quantities of guinea pig. They knitted and wove some of the most exquisite textiles the world has ever seen. They used every inch of the valley-floor for cultivation and stationed their houses, their temples and their cemeteries on the desert rim.

On the whole they seem to have been a cheerful and quite democratic people, well aware of the comic possibilities of life, and very unlike the character of their sinister northern neighbours, the Mochica. They did, however, share at least one of the Mochica's less pleasant customs – the cult of the severed head, preferably the head of a defeated enemy.

In trying to explain the existence of the Nazca observatory, Kosok outlined a theory of civilisation that has best been expounded by the German historian Kornelius Wittfogel. Wittfogel, himself a refugee from the politics of terror, saw an ominous continuum between the age of the Pyramids and the modern totalitarian state. In his scheme, the early empires of Peru, like those of Egypt and Mesopotamia, were 'hydraulic civilisations', that is, civilisations which owe their existence and their ideology to waterworks. He maintained that wherever you found large-scale irrigated agriculture, you found slave gangs and overseers. You found a population explosion and the emergence of a centralised state, with military dictators and foreign wars, whose purpose was to ensure a supply of cheap or free labour, and to purchase peace at home by sowing chaos abroad.

These early states saw the first paid informers, police methods, the systematic murder of rivals and savage inequality, with surpluses in the hands of the few and grinding poverty the lot of the masses. So important were the dates of the seasonal cycle – for planting, inundating and harvesting – that you found an outburst of astronomical calculation and astrological prediction. So important was it to keep the work-force in passive dependence, that this knowledge became the exclusive property of a caste of managerial bureaucrats, the futurologists of the ancient world. These were men morbidly

wrapped-up in themselves and responsible to nothing but the system; they dwarfed the people with monumental architecture and threatened them with implacable sky gods.

Wittfogel was on the right lines but overstated his case. Archaeologists were able to contest his thesis by pointing out that the authoritarian state came into existence *before* the large-scale waterworks and not because of them. In other words, the dictators build the dams, not the dams the dictators. Perhaps more important is one feature that all states, early and late, have in common. To achieve cohesion they fix on a symbolic, ceremonial centre, which almost invariably carries celestial overtones, appealing to the inflexible order of Heaven to sanction authority on Earth. Stonehenge, the Temple of Heaven in Peking, Red Square, St Peter's, the Ka'aba at Mecca, the Versailles of the Sun King, or the Great Pyramid, to say nothing of the installations at Cape Kennedy, are a handful of examples only. The question here is whether the Pampa de Ingenio was the centre of such a state, and whether it was the creation of a managerial caste of priest bureaucrats. This was Kosok's question.

Maria Reiche came to Peru in 1932. She was a graduate of mathematics at Hamburg University, but, as a pacifist, she knew she had 'to get as far away from Germany as possible', and managed to earn a small living in Lima by teaching. Her mother had come from Hamburg, but her father was a judge in Saxony. In the first World War he was shot through the lung and invalidated home. 'We used to ask him about the war, but he would not tell us. All the time he was thinking of his friends at the front. So he went back and this time he was shot dead. But if he *hadn't* died, I'd have been a little German bourgeois. I would *never* have escaped to the Pampa.' After seven years in Peru, she met Paul Kosok. He had just discovered the lines, but was returning to the United States. When he showed her the Pampa and suggested she put her knowledge of astronomy to practical use, she knew she had found her life's work.

For nearly forty years she has spent most of her time in the desert. She sleeps alone outside on a bed of stones, for there is virtually no rain. Her skin has burned and wrinkled in the way peculiar to those who live in arid places. She stands more than six feet tall. Despite her thinness, her legs are straight and muscular. 'One's legs are always so reliable.' Her fair hair has gone a streaky white, but her blue eyes are clear and lively, and her expression, which can at times be quite fierce, is usually one of girlish naïvety and enthusiasm for life. 'I feel things germinating inside me all the time. And at my age! But then I was very barren as a girl.' She plainly intends to live to be a hundred and says the people who live longest wear loose clothes. She eats very little; for a trip of several days she brought a packet of powdered milk, some cans of tuna fish, a block of quince paste and a bunch of bananas. She eats no meat, refusing even a bowl of consommé, though she managed a turtle steak in one restaurant.

In 1968 she published a small illustrated book about the Pampa called *Mystery on the Desert*. She had it printed for herself and arranged for its distribution. 'No editor is going to drink champagne from my skull.' The book attracted visitors from all over the world and, ever since, she and the Pampa have become something of a Peruvian institution. Most people in Lima still cannot bring themselves to take her seriously. To them she is the 'mad woman with the lines', a fanatical recluse, a regional curiosity that one should visit when driving south. Indeed, it is rather an odd sight, the old lady perched on top of an aluminium step-ladder, apparently gazing into nowhere, or measuring the desert with steel tapes.

I confess I half-expected to find her in the thrall of some mystical obsession. But instead she was one of the most hard-headed and least mystical people I have ever met. 'I do not care for the Bible,' she said. 'So much that is impenetrable. The world would be far better without it. If only we could abolish superstition!' She is a woman of sharp humour and

stout common sense, and finds the idea of herself tramping about the desert faintly ridiculous. Her claims for the Pampa are modest, she does not trumpet vague or inadmissible theories. 'I have no theory,' she said coolly. 'I have the facts.' She is convinced that Kosok was right and that the Pampa is an astronomical instrument of sorts, but she does not underestimate the uncertainties. She believes the Pampa will only reveal itself when there is an accurate survey. This is the job she has set herself, an undertaking so vast that it will see her out. It is, however, a one-woman operation and I would not like to be the one who encroached on her territory. The Wenegren Foundation in New York once offered her the services of experts. 'But I, who have worked here for forty years, what am I if I am not an expert?'

She thinks that the method of transferring the figures to the ground was relatively simple. There was a standard unit of measure, based on the human body, probably the arm-span. This was transferred to a piece of string, and doubled and doubled ad infinitum, or halved and halved until it corresponded to the space between the knuckles. She hopes to isolate the exact standard length, like the Megalithic Yard which Professor Thom of Glasgow has found to underlie the placing of standing stones in Neolithic monuments in the British Isles. But she is coming to the depressing conclusion that the Nazca people employed slightly different standards. When plotting a figure on the desert they will have used a string with a peg at either end, one to scratch the surface, the other stuck in the ground. The outline of the spider, for example, is a succession of smoothly joined arcs of very different radii. I spent one morning with Maria demonstrating how it was done. 'One of those bearded people', she said, 'suggested I use aerial photographs. But I would *never* get the centre of the radii, so *what* is the point?' All morning, and into the blazing afternoon, she hopped about with her steel tapes, jumping from one line to the next, always on the white, and never on the brown surface of the Pampa. She could add up strings of

decimals in her head, and, when these got too much for her, she scribbled them on the folds of her dress.

The Pampa is very vulnerable. For years Maria Reiche laboured to get people to recognise its importance. But now it is famous, the visitors are ruining it as fast as they can. Horses, cars, motor-bikes and dune-buggies have made their everlasting white tracks on the brown surface. Footprints have nearly blotted out the spider. Tourists and 'even the ignorant people from the museums' have added their own improvements to the figures. There are threats to criss-cross the Pampa with pylon lines and even to irrigate it. She has to watch this destruction with a quiet, fierce despair. 'It is terrible, *terrible*. One day I shall stand it no longer and I shall leave the Pampa.' She does not think she has enough official support, but the problems of protecting it are an official's nightmare. The Archaeological Service of Peru is hard-pressed enough. How can it cope with another site of a hundred thousand acres? The solution would be to declare it out of bounds, like a military zone, and she has something like this in mind. Meanwhile she will not distribute her book in Peru until she has official safeguards.

Another morning we went to look for a place where parallel lines rush across the floor of a dried watercourse and ride up to the mountains on the farther side. She woke me at four. She drank her milk, ate some bananas, and we started out over a lunar-like landscape, plantless but for the odd cactus, her great German legs striding out in front. About sunrise she turned to climb a scree. Some way up the escarpment, she slipped and began rolling down in a cloud of dust and stones. I hurried back to pick up the pieces, but found her sniggering with laughter at the bottom.

'I am so glad I learned how to ski when I was a child. Skiing teaches you how to fall.' I offered to carry her bags — an offer she had refused earlier — and, free of their weight, she climbed the hill, expecting to find the lines at the top. But when I caught up with her, sweating and out of breath, she said:

'Alas, we are on the wrong pampa!' We did not find the right pampa for another hour.

Maria Reiche has had a further dose of trouble, only this time from a rather cursory North American expedition that came to the Pampa, and went again, when she was not there. 'Expedition!' she snorted. 'With the Pan-American Highway running close by! This is *not* what I call an expedition.'

The unwanted visitor was Gerald Hawkins, the Anglo-American professor of astronomy from Boston, who made a name for himself in the early Sixties, when he announced he had 'decoded' Stonehenge and that it was a 'Neolithic Computer' for calculating equinoxes, solstices and eclipses. Hawkins irritated the 'professionals' at the time by his apparent failure to take awkward facts into account. In any case, having 'decoded' Stonehenge, he set about decoding other astronomically aligned monuments, including the Temple at Karnak in Egypt. Then he decided to take on the Pampa. He arrived one day with a team of surveyors and took what must have been a few rather hasty sightings. The 'expedition' even landed its Piper Cherokee on the surface of the Pampa. Hawkins returned to the United States with a set of aerial photographs, taken vertically by the Servicio Aerofotografico de Peru. He selected a number of lines and geometric forms, fed their alignments into his computer, fed also into the computer information of the movements of the sun, moon and constellations over 2,000 years and more, and announced, with a certain glow of satisfaction, that whereas a few lines *might* point to solstices and equinoxes, there were far too many that did not. 'The Sun-Moon-Stars theory', he wrote, 'has been killed by the computer.'

Maria Reiche is not the woman to accept this kind of thing submissively. After years of patient plotting and calculating, she is confident of her method and scorns the omniscience of the computer expert. Furthermore, she insists that working from aerial photographs must give extremely inaccurate results. 'This Hawkins spent very little time here. He could

not have taken proper azimuths of the horizon. What kind of astronomy is that?'

Another visitor to the Pampa was Erich von Daniken, the Swiss fantasist and author of two books, *Chariots of the Gods?* and *Gods From Outer Space*, which have sold 4,000,000 and 2,000,000 copies respectively. Von Daniken's thesis, which is not particularly original, is this: at some remote period, beings from Outer Space (the Gods) landed on Earth in flying saucers (their chariots), bringing with them a genetic engineering factory, in which they created, from inferior hominid material, *Homo sapiens*, possibly making the first woman in a retort. It comes as no surprise, in this rewriting of Genesis, to learn that the Pampa de Ingenio was a prehistoric airport, or space centre for gods. And in one shameless bit of cheating Von Daniken illustrates the leg-joint and claw of the big guano bird with a caption, 'Another of the strange markings on the Plain of Nazca. This is very reminiscent of aircraft parking areas in a modern airport.'

Maria Reiche knows how to cope with the saucer watchers. 'They are ignorant and uncultured people and they are usually in it for the money.' But another class of visitor totally mystifies her. The publication of her book coincided with the avant-garde phenomenon known as Earth Art. In the late Sixties artists in Europe and America reacted to the tyranny of the art gallery, and, with the ecological movement under way, felt it was time to return to the Earth that bore them. The New York artist Claes Oldenberg dug a 'grave-like pit' in Central Park. Walter de Maria drew parallel lines in chalk a mile long in the Mojave Desert, and then announced a project for a pair of walls a mile long. Artists were suddenly interested in every kind of prehistoric earthwork, in crop marks, in barrows, in the White Horses of Iron Age Britain, in the Spiral Mound in Ohio, and in the desert drawings of the Australian Aborigines, who ritually enacted the migrations of their ancestors by drawing them on the ground and dancing round them. Even the collectors entered into the spirit of the movement.

Robert Scull commissioned the artist Michael Heizer (whose father was a pre-Columbian archaeologist) to dig a huge cut in the desert, and said, in a lecture at the Metropolitan Museum, that it was one of Man's deepest instincts to cut into the ground, and that, whatever his wife Ethel thought, part of the thrill of owning Heizer's piece was that it was stuck out in the desert and you couldn't have it shipped and auctioned at Parke-Bernet Galleries.

It was inevitable that the Earth artists should visit the Pampa. I particularly liked Maria Reiche's version of her encounter with a conceptual artist. 'I said to him, "What are you doing on the Pampa?" and he said, "I am an artist." "What kind of artist?" "I change the landscape." "Well, I hope you are not going to change *this* landscape." *What* can you do with such people? Nature is beautiful. The Pampa is beautiful, and *they* want to change it.'

Maria Reiche is not a recluse, and since she has become something of a cult figure, she basks in the publicity. 'I am Elizabeth Taylor in front of the camera.' Lufthansa, with its gatherings of the avant-garde in Germany, where she gets even more perplexed by the dense language of her admirers. Before we left Nazca she wanted to collect her mail from the post office. She came out staring at a card, printed with squares like graph paper. On it were ruled, in black ink, six plain rectangles divided down the centre. Above, a neat caption ran: A Series of Six Paintings each with a Central Vertical Division. It was, in fact, the prospectus from an art gallery in Düsseldorf, of an exhibition by a young English painter called Alan Charlton. 'I do not know what it is,' she said. 'I think they have not included the letter in the envelope. Perhaps it is for Government stamps?'